MONSANTO

# REVIEW OF APPLICABILITY OF DATA CONSIDERED FOR ENDANGERED SPECIES ACTION AREA DETERMINATION

**TEST GUIDELINE**

Not Applicable

**STUDY COMPLETION DATE**

September 14, 2018

**SPONSOR/PERFORMING TESTING FACILITY**

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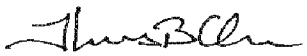
| **Signature:** |  |
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This report does not meet the requirements of the Good Laboratory Practice (GLP) standards as specified in 40 CFR Part 160 as it is not a study *per se* but an assessment of data from other studies and reports.

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## COPYRIGHT INFORMATION PAGE

**Introduction**

EPA's Environmental Fate and Effects Division is currently undergoing an Endangered Species Assessment in support of EPA's pending determination of whether to amend the registration of XtendiMax® With VaporGrip® Technology (XtendiMax) prior to its expiration on November 9, 2018. XtendiMax is a low-volatility dicamba formulation specifically designed to manage glyphosate-tolerant and other hard-to-control weeds when applied over-the-top of dicamba-tolerant soybean and cotton crops. Although dicamba formulations have been registered and widely used for decades in lawns, gardens, and agricultural crops such as corn and pastures, XtendiMax is a next-generation formulation with significantly less potential to volatilize. Recognizing soybean and cotton growers' significant need for this new tool, EPA registered XtendiMax on November 9, 2016, based on scientific submissions provided to the agency over the preceding five years, including dozens of scientific studies and field trials assessing the potential for spray drift and volatility. The XtendiMax label was tailored to address that scientific review, with specific requirements to limit the potential for off-target movement, including an in-field buffer, wind speed restrictions, ban on aerial application, and spray nozzle requirements.

As part of its Endangered Species Assessment, we understand that EPA intends to rely on the Master's Thesis of University of Arkansas student, Gordon Travis Jones, presenting an "Evaluation of Dicamba Off-Target Movement and Subsequent Effects on Soybean Offspring" ("Master's Thesis").[1] We understand that the Master's Thesis may form the basis of EPA's determination of the action area for Endangered Species Act purposes. Although the Master's Thesis probes interesting research topics, we have serious concerns with EPA's reliance on this Master's Thesis, given its significant limitations, including its lack of relevance to the regulatory assessment at issue and important questions regarding study design. Furthermore, these results from the Master's Thesis are not consistent with other available dicamba studies. Specifically, the Master's Thesis reported yield reduction to soybean at a distance of 90 meters from application. We are unaware of any other studies of dicamba off-target movement that reports yield reduction at anywhere close to that distance. These results are not suitable for an action area assessment for a number of reasons, including that the Master's Thesis did not use XtendiMax, but another dicamba formulation without VaporGrip Technology, it did not use a drift reduction agent as the proposed label requires, and it used an unapproved nozzle that increases spray drift. Even setting aside these flaws, the 90-meter result is spurious because the Master's Thesis itself showed <5% visual injury and <5% pod malformation at 90 meters. For the reasons described in more detail below, this Master's Thesis is inappropriate to inform either an Endangered Species Act action area assessment or mitigation and restrictions designed to avoid off-target movement because it is not consistent with Xtendimax label requirements and grossly exaggerates potential for off-target movement. In contrast, EPA has obtained numerous

[1] Jones, Gordon Travis, "Evaluation of Dicamba Off-Target Movement and Subsequent Effects on Soybean Offspring" (2018). Theses and Dissertations. 2667. http://scholarworks.uark.edu/etd/2667

Good Laboratory Practice (GLP) studies that meet EPA's data quality obligations[2] and that have evaluated the potential for off-target movement of dicamba under representative conditions appropriate for the regulatory assessment at hand. A summary of these studies follows the critique of the applicability of the Master's Thesis below.

**Critique of Applicability of Master's Thesis for Action Area Determination**

As an initial matter, the Master's Thesis is inadequate to support any evaluation of an Endangered Species Act action area because it is wholly irrelevant to the registration decision for XtendiMax **for at least four reasons**. **First**, it did not test XtendiMax with VaporGrip technology, rather it used a diglycolamine (DGA) and a N,N-Bis-(aminopropyl) methylamine (BAPMA) form of dicamba, each of which did not contain VaporGrip. **Second**, the study methodology did not use a drift reduction agent, which would be required for all applications according to the proposed XtendiMax label language. **Third**, the methodology used the AIXR 11003 spray nozzle, which is not approved on the XtendiMax label and would produce a very coarse droplet that would significantly increase spray drift relative to the XtendiMax approved nozzles that produce an extremely-coarse or ultra-course droplet spectrum. **Fourth**, the Master's Thesis evaluated soybean growth stages that are less likely to be exposed when Xtendimax is applied according to label instructions. It evaluated reproductive stages only, so did not capture a representative application since the current label does not allow spray applications after the R1 growth stage. This is important because potential impacts to yield would be greatest at reproductive growth stages and, therefore, would overestimate potential effects of a label-compliant application. While the Master's Thesis alleges that there is a likelihood of dicamba applications being made when non-dicamba resistant soybean are in reproductive growth stages in the vicinity of dicamba-resistant soybean, it offers no support for that assertion and it is inconsistent with typical agronomic practices. Soybeans in the vicinity would be (1) planted with a similar maturity group and (2) planted at similar dates, so it would be unlikely for there to be much difference in growth stage. Moreover, Monsanto encourages growers to spray early which would further reduce the potential for neighboring crops to be close to or at the reproductive stages.

The Master's Thesis also suffers from fundamental flaws regarding the transparency of the data and study design.[3] **First**, it is not a GLP study, nor were quality control measures akin to the GLP standards in place, thus the Master's Thesis does not meet EPA's data quality standards. **Second**, the study's result of 5% yield reduction at 90 meters (Trial 11) is spurious for many reasons. As an initial matter, 19 out of 20 calculated distances to 5% yield reduction are less than 45 meters (as illustrated in the figure below) and the 90-meter measurement is the only one beyond that. Moreover, the calculated distance of 90 meters for 5% yield reduction in Trial 11 is fundamentally inconsistent with all other endpoints in Trial 11, each of which is known to

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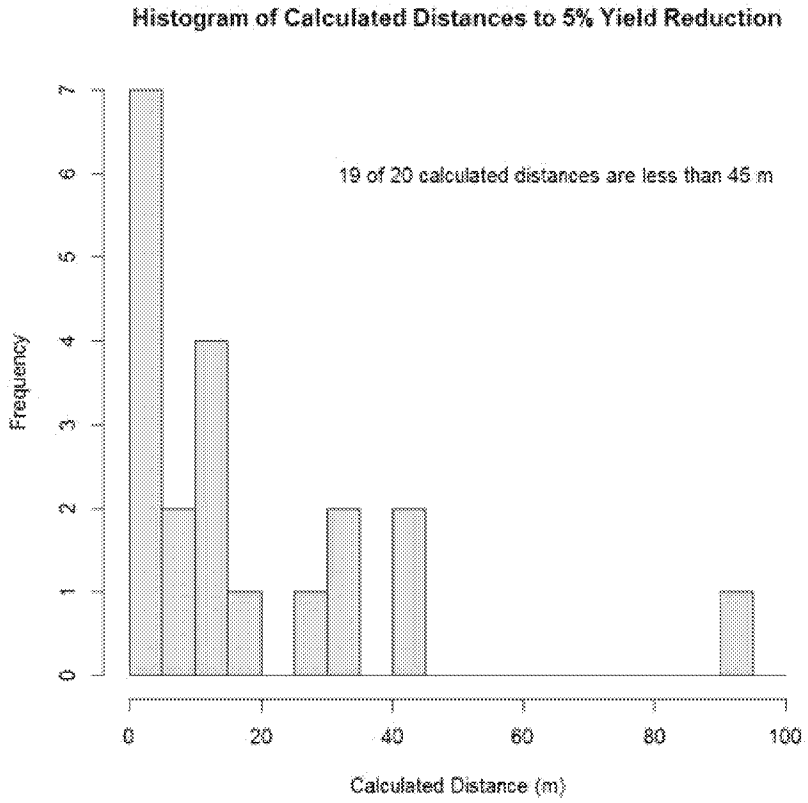
[2] The Good Laboratory Practice Standards codified at 40 C.F.R. Part 160 were promulgated "to assure the quality and integrity of data submitted" to EPA under FIFRA. These and other FIFRA data requirements comply with EPA's information quality obligations under Section 515(a) of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Public Law 106-554; H.R. 5658).

[3] Bayer does not have access to any raw data or written protocol relative to the Master's Thesis.

be *more sensitive* than yield; however, Trial 11 results reflected the opposite trend in which yield was the most sensitive endpoint. For example, 5% visual injury was reached at 60.6 meters, 5% height reduction at 28 DAA was reached at 0 meters (i.e., no impact on height), 5% height reduction at harvest was reached at 15.4 meters, and 5% pod malformation was reached at 60.6 meters. Close inspection of the yield data for Trial 11 (Appendix Figure 22) illustrates that the calculated 90 meters is the result of spatial confounding, and therefore spurious - note the presence of two spatially-segregated clusters, each of which is flat. **Third,** the study design lacked an untreated check to serve as a control mechanism to confirm that observed effects were related to dicamba exposure and not caused by some other variable. **Fourth**, the Master's Thesis normalized yield results to control plants, which may not be representative of plants located in a downwind area. **Fifth**, reported results in the Master's Thesis rely on the worst-case transect only and do not incorporate variability from measurements at other transects that were not reported.




**Ample Relevant Data are Available to Support Action Area Determination**

In contrast to the flawed Master's Thesis, EPA has ample relevant data to provide robust support for the Endangered Species Act action area assessment. As discussed in "The Scientific Basis for Understanding the Off-Target Movement Potential of XtendiMax" (MRID 50642701; referred to here as the "White Paper"), since the initial registration in 2016, Monsanto has conducted a total of five additional formulation-specific EPA guideline volatility field studies to

supplement the numerous materials supporting the 2016 XtendiMax registration. In fact, these additional studies even utilized the XtendiMax tank mix that is used on 90% of all dicamba-tolerant soybean and cotton acres: XtendiMax (MON 76980) plus PowerMax (MON 79789, a glyphosate potassium salt) and a drift reduction agent. Monsanto has provided comprehensive data sets developed through GLP studies[4] on all aspects of off-site movement.

Notably, Monsanto submitted a field study conducted in Arizona that evaluated volatility, spray drift, and plant effects (MRID 50642801) and corresponding deposition and air concentration modeling (MRID 50642804), which confirmed that plausible effects of dicamba would be limited to the confines of the treated field, and thus no species off the field would be affected as a result of application. As noted in the White Paper, in designing the Arizona field study protocol, Monsanto solicited feedback from EPA and incorporated study design recommendations from the Agency. Using the flux rates determined from the Arizona field study, Monsanto modeled the dicamba dry and wet deposition and air concentration estimates that could potentially occur downwind of an application of the XtendiMax tank mix (MRID 50642804). The results of the air concentration modeling were below both the NOAEC used in the 2016 XtendiMax registration and the refined NOAEC later determined at EPA's request. As discussed in the White Paper, a spray drift field study conducted in conjunction with the Arizona volatility field study was confirmatory of (1) EPA's 2016 determination that no spray drift would occur outside of the 110-ft. buffer area in amounts that could have an effect on plant height, and (2) a Texas field deposition study that showed that dicamba would be present in amounts below the no-effect rate (NOER) at distances less than 110 feet from the edge of the field (MRID 49770301). Thus, the Arizona volatility and spray drift field study confirms EPA's 2016 conclusion that no buffer is necessary to address concerns regarding volatility and that a 110-ft. buffer is sufficient to address concerns about spray drift.

EPA also has the Kniss (2018) paper that updated the meta-analysis originally completed by Egan et al. (2014), adding 5 studies (11 in total) that evaluated soybean response to dicamba. Results are consistent with the extensive set of GLP (or similar) studies that characterize formulation-specific exposure and effects, and further confirm the adequacy of existing label requirements designed to limit the potential for off-target movement. Specifically, using pooled data across studies, Kniss (2018) found that, when exposed at early vegetative stages (V1-V3), the lowest dicamba dose causing 5% yield loss was 1.9 g/ha; this dose is approximately 6.5 times greater than NOAEC of 0.29 g/ha derived from the GLP vegetative vigor study (Porch, 2009; MRID 477815102). When applied at late vegetative stages (V4-V7), the lowest dicamba dose causing 5% yield loss was 5.7 g/ha, or 19.6 times greater than the NOAEC. Soybean in the flowering stage (R1-R2) was shown to be consistently more sensitive to dicamba exposure. Nevertheless, the lowest dicamba dose causing 5% yield loss was 0.89 g/ha, which is still 3X larger than the NOAEC. The Kniss meta-analysis clearly demonstrates that available peer-reviewed literature overwhelmingly supports EPA's determination that (1) soybean plant height is the most sensitive endpoint and any mitigations that are protective of reductions in plant height will also be protective of yield loss and (2) these results hold true for all growth stages evaluated

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[4] The Australia field study was not a GLP study, however as discussed in the White Paper, there were quality control measures in place akin to the GLP standards to ensure the accuracy and validity of the study.

(early vegetative, late vegetative, and early reproductive growth stages). Kniss also attempted to quantify the relationship between visual symptomology and yield. These results demonstrated that visual symptomology is not a reliable indicator of plant effects; instead, quantitative measures provide a more robust measure of potential effects than visual symptomology. Furthermore, as noted above, plant height, an apical EPA endpoint, would also be protective of potential yield losses.

In summary, EPA has available to them GLP (or similar) studies that characterize potential off target exposure from (1) a formulation-specific field spray drift deposition study and (2) multiple formulation-specific field volatility studies conducted across a range of environmental conditions. Furthermore, non-target plant effects data are available from (1) a GLP vegetative vigor study (Porch, 2009; MRID 477815102) and (2) a refined vapor-phase plant effects endpoint (Gavlick, 2016; MRID 50578901). Collectively, these studies provide a robust, transparent, and defensible means by which to fully characterized potential risk to threatened and endangered species to support a registration decision for XtendiMax.

**Conclusion**

Monsanto has serious concerns about EPA's reliance on the Master's Thesis for an Endangered Species Assessment. Given the significant limitations of this paper, the Master's Thesis is not suitable to support the regulatory decision at issue. As noted above, it grossly exaggerates potential for off-target movement because the study was conducted using a formulation without VaporGrip Technology under conditions that were inconsistent with the Xtendimax label. In contrast, EPA has numerous regulatory quality data sets that are formulation-specific, conform to EPA guidelines, and follow robust EPA procedures intended to ensure the integrity of the data, and therefore much better suited to address the registration decision and supporting analysis. This voluminous scientific evidence, as summarized in the White Paper, confirms the conclusions regarding spray drift and volatility in EPA's 2016 risk assessment (and subsequent addendums) and registration decision.